

Work (scientific definition):

[Brainstorm ideas]

- Force exerted on another object
- Energy put into something
- Energy expended to create force
- Work equals force times distance
- Power needed to do something

"Official" Scientific Definition of Work:

$$\text{Work} = (\overline{\text{Force}})(\overline{\text{displacement}})$$

↳ scalar ↳ vector ↳ vector

- Short aside: two ways to multiply
vectors

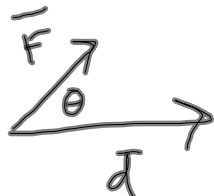
One gives a scalar answer, other gives
you a vector answer.

We will be using scalar answer.

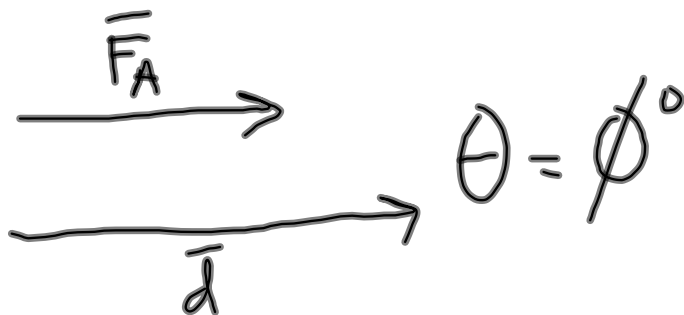
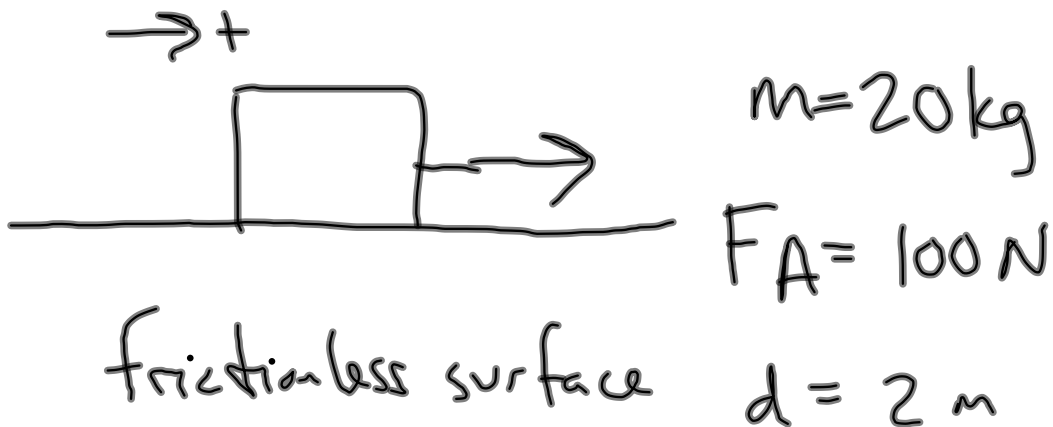
$$W = \overline{F} \cdot \overline{d} \quad \text{Dot product}$$

$$= F d \cos \theta$$

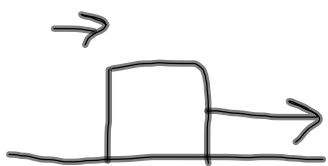
↳ angle ^{between} \overline{F} and \overline{d}
↳ magnitude of displacement
↳ magnitude of F



$$\text{Units: Joules} = N \cdot m = \frac{\text{kg} \cdot \text{m}^2}{\text{s}^2}$$



$$\begin{aligned}
 W_{\text{net}} &= W_A = F_A d \cos \theta \\
 &= (100 \text{ N})(2 \text{ m}) \cos(0^\circ) \\
 &= 200 \text{ J}
 \end{aligned}$$



$$\mu_k = 0.25$$

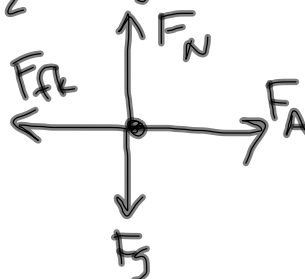
find W_{net}

$$\begin{array}{c} \vec{d} \\ \vec{F}_A \end{array} \quad \theta_1 = 0^\circ$$

$$m = 20 \text{ kg}$$

$$F_A = 100 \text{ N}$$

$$d = 2 \text{ m right}$$



$$\begin{array}{c} \vec{d} \\ \vec{F}_{fk} \end{array} \quad \theta_2 = 180^\circ$$

$$\begin{aligned} W_{\text{net}} &= W_A + W_f \\ &= F_A d \cos \theta_1 + F_{fk} d \cos \theta_2 \\ &= (100 \text{ N})(2 \text{ m}) + (49 \text{ N})(2 \text{ m})(-1) \\ &= 102 \text{ J} \end{aligned}$$

$$F_{fk} = \mu_k F_N$$

$$= (0.25)(196 \text{ N})$$

$$= 49 \text{ N}$$

$$\sum F_y = 0$$

$$F_N - F_g = 0$$

$$\begin{aligned} F_N &= F_g \\ &= 196 \text{ N} \end{aligned}$$